Parks and Recreation Facilities
No change from the No Action Alternative. There are no parks or developed recreation facilities located on DNR trust lands. No direct impacts are expected to facilities located on adjacent public or private lands.

Communications
No change from the No Action Alternative. The Preferred Alternative neither impacts communication site leases nor limits new site opportunities. DNR would continue to lease communication tower and building space, increase rental rates as market conditions allow, and seek new customers.

Water/storm Water Management
There are no probable significant impacts to bridges or the Brannian Creek fish hatchery water intake from peak flows under the preferred alternative.

Sewer/Solid Waste Management
No change from the No Action Alternative. Since most DNR-managed lands in the planning area are designated for commercial forest uses there has been no need for sewer or solid waste planning. Solid waste management has been limited to cleanup of unauthorized garbage dumping.

Alternative 3

Natural Environment

EARTH
Approximately 5,475 acres of the 15,707 acres of trust land in the planning area would be available for timber harvesting under Alternative 3. No harvesting would occur on 5,590 acres of unstable slopes and associated buffers except for minor removals in the outer 50 feet of the buffers to achieve "edge feathering." There would be 1,131 acres of riparian buffer and 930 acres of wind buffer. Approximately 700 acres have been identified as possibly inaccessible for harvesting under this alternative.

About 33 miles of new road would be constructed during the next 140 years. No road construction would occur on unstable or potentially unstable slopes. An average of 29 acres – all in thinnings or partial-cuts – would be harvested annually.

Unstable Slopes
Short-term: Direct Impacts – Indirect Impacts
The potential for slope failures to occur as a result of new road construction would be minimal since no roads would be constructed on unstable slopes and virtually none would be constructed on potentially unstable slopes. This would be a reduction in potential for slope stability related impacts compared to the No Action Alternative but essentially no change from the Preferred Alternative.

All unstable slopes would have a 140-foot buffer, and only 20 percent harvest could occur in the outer 50 feet of the buffer. Only partial cutting, which retained over 50 percent of the trees, could occur on potentially unstable slopes. Harvest proposals on these sites would be reviewed on-site by a DNR slope stability specialist, and by the inter-jurisdictional committee. The probability for slope failures to result from harvest-related loss of root strength and/or changes in soil-water input on unstable and potentially unstable slopes would be virtually eliminated under this alternative. This very low risk would be a reduction compared to the No Action Alternative but only a minimal reduction from the Preferred Alternative.

Surface Erosion

Short-term: Direct Impacts – Indirect Impacts

Erosion potential from exposed soils associated with road construction would be less than under the No Action Alternative due to a 47 percent reduction in total miles of new construction, and virtually no new roads on sensitive sites. (The Preferred Alternative represented a 31 percent reduction in total miles of new road compared to the No Action Alternative). Mitigation discussed in the No Action Alternative is applicable here. Also, DNR is directed to search for a viable alternative haul route to replace the lower portion of the LM-2000 Road. If such a route is located and constructed, the potential for sedimentation to Austin Creek would be reduced slightly.

Unstable Slopes and Surface Erosion Long-term: Direct Impacts – Indirect Impacts

The potential for impacts would be insignificant. The potential would be less than the No Action Alternative because of more restrictive road construction and timber harvest strategies and a smaller amount of planned activity. Sediment delivered to stream channels would originate primarily from existing roads.

Unstable Slopes and Surface Erosion Cumulative Impacts

The potential for cumulative impacts from implementation of this alternative would be a reduction from the No Action Alternative and the Preferred Alternative. The changes would be due mainly to planned activities being spread across a 140-year period as opposed to 60 years.

AIR

Climate/Air quality

Short-term impacts only, similar to the No Action Alternative. The already low potential for impacts is reduced even further from the No Action Alternative and the Preferred Alternative due to reduced level of harvest activities.

WATER

Surface Water Quality

Alternative 3 requires 140-foot buffers to be left on the edges of unstable areas. Therefore the risk of mass wasting and delivery to surface waters is somewhat less than the risk under the No Action or Preferred alternatives. Otherwise there are no additional benefits to surface water quality.

Surface Water Quantity
Water yield and peak flows will not be significantly different from the quantities under the Preferred Alternative.

Ground Water Quality
There is no further mitigation for ground water quality under Alternative 3 than under the Preferred Alternative.

Ground Water Quantity
This alternative requires that 140-foot buffers be left on the edges of unstable areas. If harvesting occurs upslope from an unstable area, the buffer may reduce the amount of additional subsurface flow delivered to the unstable area because of the harvest. As the length of the harvested slope is increased the significance of the reduction becomes less.

Public water supply
There are no probable significant adverse impacts to the public water supply under this alternative.

PLANTS AND ANIMALS

Forest Vegetation: Upland, Riparian, Wetland
Upland vegetation: General Forest Ecology Perspective
Short-term: Direct Impacts
Short-term impacts would be observed within those units harvested in the first decade, where heavy thinning (as opposed to regeneration harvests) would leave more trees in the units, wider riparian buffers would protect a higher percentage of the forest, and more snags and down logs would be left than in the No Action Alternative.

Long-term: Direct Impacts
By 50 years, 86 percent of the planning unit would be in the complex stand condition (For descriptions, see PDEIS pages 106-107). This is in contrast to the No Action Alternative, which at 50 years would have about 56 percent of its acreage in the complex stand condition.

Cumulative Impacts
Frequency of entry into forest stands would decrease by approximately 50 percent compared to the No Action Alternative. This would decrease potentially harmful cumulative impacts. See PDEIS page 224 for further discussion of the types of impacts likely to be reduced.

Unavoidable Adverse Impacts
Unavoidable impacts would result from the construction of 33 miles of new roads. This is about half the number of new road miles as in the No Action Alternative, and 10 fewer road miles than in the Preferred Alternative. Please see PDEIS page 160 for road associated impacts.

Riparian and Wetland Vegetation: General Forest Ecology Perspective
Short-term: Direct Impacts – Indirect Impacts
Increased buffer widths on all streams, restrictions on yarding across streams and construction of stream crossings, and further restrictions on operations on unstable slopes would reduce

sediment inputs, provide more protection to riparian and wetland soils and vegetation, and potentially positively affect stream temperatures on those streams receiving the buffers and possibly on downstream reaches as well.

Long-term: Direct Impacts – Indirect Impacts
Long-term impacts would be the same as the short-term impacts. In addition, wider buffers could contribute more down logs to riparian areas, with consequent impacts on water routing, channel morphology, and sediment transport.

Cumulative Impacts
Cumulative impacts to small wetlands and streams would be reduced through protection from larger buffers, and reduced frequency of entry associated with longer rotations.

Mitigation – Landscape Plan Proposal
Same as in the No Action Alternative.

Unavoidable adverse impacts
As with the No Action Alternative, some small wetlands will defy detection and suffer impacts due to timber harvest within and near them.

Forest Health: Insects and Disease
Short-term: Direct Impacts – Indirect Impacts
Alternative 3 has less land accessible for commercial forestry activity, a longer rotation age, and more retention requirements for harvest units than the previous Alternatives. This may indirectly reduce commercial productivity and options by preventing aggressive treatments to improve stand vigor and reduce structures that are conducive to forest insect and disease activity. The ecosystem is not threatened. Snags, logs, and old forest structures will increase over time. General tree age and late seral structures will increase, increasing risk of activity from forest insects such as hemlock looper, Douglas-fir beetle, hemlock dwarf mistletoe, and heart-rotting fungi.

On managed sites, approximately 50 acres treated per year, the retention requirements for buffers and unstable slopes plus the requirement to permanently retain 25 percent of the trees in any harvest unit, could be detrimental to commercial productivity by preventing aggressive efforts to change forest structure or composition or remove diseased individuals. Over time stands will shift toward late seral conditions, becoming more prone to insect and disease activity.

Alternative 3 seeks to protect riparian, aquatic and wetland ecosystems through forbidding the use of aerially applied chemicals. Chemical pesticides are seldom used in forest situations for insect and disease control. However, if the resource to be protected (vegetation, forest products, habitat) is seriously threatened, forest chemicals can be an effective and economical, management option. The lack of opportunity to use aerial application methods will greatly increase the costs and reduce the efficacy of such a treatment, if needed. Direct treatment of forest problems is less likely to occur under such a scenario and valuable structures such as high value commercial forest products, mature trees, or special habitats may be lost.

Mitigation – Landscape Plan Proposal
Alternative 3 mentions that retention of all existing snags will be emphasized, where safe and practicable. Snag and hazard tree removal will be necessary around places people recreate in order to ensure their safety and avoid liability to the Department.

In the most extreme potential case of an aggressive, exotic pest being detected in the Lake Whatcom landscape, not unlikely due to proximity to Bellingham and Vancouver Ports, the Washington State Department of Agriculture could obtain legal access and use aerially-applied chemical tools in this watershed regardless of local preferences or policy. Therefore this restriction potentially adds expense and may threaten some vegetation or habitat resources, but risk to the larger ecosystem could likely be avoided.

Rare and Sensitive Plants
See Affected Environment: Rare and Sensitive Plants.

Animals
The same species-specific protection identified under the No Action Alternative applies to Alternative 3.

Short- and Long-term, Cumulative Impacts
Short- and long-term impacts listed under the No-Action Alternative would be decreased even more under Alternative 3 than under the Preferred Alternative, due to further restrictions on harvest and/or road-building activities. The larger riparian buffers provided under Alternative 3 have the potential to provide more effective mitigation for amphibians, as well as birds, small mammals, and other fauna associated with riparian habitat, as well as interior and/or mature forest habitat.

The buffer sizes for Type 1-4 streams under the No-Action and Preferred Alternatives have been determined primarily for the clprotection of salmonid habitat (see DNR HCP, Chapter IV, p. 56). Several studies have shown that wide buffers will result in greater abundance of some amphibian species associated with aquatic habitats (Rudolph and Dickson 1990), higher densities of riparian-associated birds and total birds (Kinley and Newhouse 1997), and greater species diversity of terrestrial vertebrates (O'Connell et al. 1993). The general range of buffer size that has been considered "wide" in the published studies has been from 130-230 feet on one side of a stream.

It should be noted, however, that the optimum or minimum size of buffers for providing habitat for both permanent and transient riparian-associated wildlife is yet to be determined. The key provisions of a buffer for aquatic-breeding amphibians are a closed canopy, maintenance of water temperature, and prevention of increased sedimentation (O'Connell et al. 1993). These can be provided by relatively narrow buffers (less than 100 feet). However, there is very little literature addressing the impacts of varying buffer sizes on amphibians. There is currently more literature addressing birds and small mammals in relation to buffer size. If the goal of riparian buffers is to support near-natural densities of riparian-associated birds at the stand level, then buffers of at least 200 feet would be needed (Darveau et al. 1995, Kinley and Newhouse 1997).

The most significant difference in buffer width under Alternative 3 is for Type 5 streams (150 feet, compared to 33 feet under the Preferred Alternative, and no buffer under the No-Action Alternative). This size may exceed the needs of most species associated with first-order streams (primarily aquatic-breeding amphibians), but may provide additional benefits to other fauna associated with riparian and mature forest habitats. Buffers for Type 3 and 4 streams (200 and 150 feet, respectively) would only be slightly larger under Alternative 3, as the average buffer width under the other two alternatives would likely average around 160-180 feet for Type 3 streams, and 100 feet for Type 4 streams.

The second-most significant difference in buffer width under Alternative 3 would be for Type 1 and 2 streams. Under the other two alternatives, the average width of buffer would likely be 160-180 feet, compared to 250 feet under Alternative 3. The latter size is actually in the range of buffer widths found to support near-natural densities of forest-dwelling birds (Darveau et al. 1995, Kinley and Newhouse 1997). However, some literature reports the need for buffers of 300, 400, and even 580 feet to support interior forest-associated species and other "sensitive" species (Croonquist and Brooks 1993, Gyug 1995, Spackman and Hughes 1995). There is the potential under this alternative to provide such buffers, where the 140-foot wind buffers would be applied.

These large wind buffers could provide one of the most significant positive impacts to wildlife under Alternative 3. Where they would be applied, the riparian buffers could provide an additional benefit for interior forest-associated species. It should be noted that it is believed that even the widest buffer zones studied, if isolated from contiguous mature forest, would be too small to maintain all species of neotropical migratory birds, due to "edge effects" of nest predation and brood parasitism (Kinley and Newhouse 1997). However, with the additional areas that would be restricted or inaccessible due to buffers or other constraints, a large portion of the buffers are expected to remain contiguous with mature forest blocks.

As mentioned for the Preferred Alternative, hardwood conversion still would be likely to occur (Objective #12 remains the same), but even fewer areas would be accessible for management.

A significant difference under Alternative 3 compared to the other two alternatives is the requirement to incorporate Washington State Department of Fish and Wildlife Priority Habitat Species (WDFW PHS) management guidelines for all wildlife species that have such guidelines. Most listed and unlisted species of concern that are likely to occur within the Lake Whatcom planning area would be provided protection through the Forestry Handbook procedures under the other two alternatives. However, some of the PHS management recommendations are more specific regarding timing restrictions or buffers (i.e., for common loon, marbled murrelet), or other habitat requirements (i.e., for harlequin duck, pileated woodpecker, Vaux's swift). Realized management or protection would be virtually the same under either set of guidelines for bald eagles, common loons, harlequin ducks, pileated woodpeckers, and Vaux's swifts.

Management for northern goshawks could be significantly different, as current Forestry Handbook procedures provide protection only for active nests within designated Nesting, Roosting and Foraging habitat (NRF). However, recent practice has involved consultation with region and WDFW biologists, and has usually resulted in protection recommended by WDFW. Official PHS recommendations have not been finalized for this species.

Management for marbled murrelets is currently following "interim guidelines" under both HCP and PHS guidelines. Although the PHS recommendations are more committed to providing timing restrictions within ½ mile of occupied sites, this is currently a moot point. If habitat develops to support nesting murrelets within the watershed in the future, it is anticipated that a long-term strategy will have been developed in consultation with WDFW (and United States Fish and Wildlife Service). For more information regarding the difference in guidelines, see DNR Forestry Handbook, Larsen and Nordstrom 1999, and Roderick and Milner 1991.

More significant than the differences in management would be the requirement to inventory all existing suitable habitat (for all applicable species). This would involve a considerable resource commitment, particularly for northern goshawks and pileated woodpeckers, with unknown or potentially little "return" for the effort. Inventorying all suitable habitat that may be considered for management activities may be more efficient and effective. This requirement would have the potential to more adequately protect and/or mitigate impacts to species that are difficult to detect without surveying, such as goshawks and pileated woodpeckers.

One other key difference under Alternative 3 is the requirement to protect locally rare or uncommon native vegetative communities within the watershed (e.g., the 100-year-old bigleaf maple stand). This particular type of plant community is not addressed in the Forestry Handbook procedures, so protection under the other two alternatives is not predictable. However, other uncommon habitat (such as balds, caves, cliffs, mineral springs, talus fields) are addressed and provided protection under the procedures, whereas they are not specifically addressed under the PHS management recommendations.

Further buffering and restrictions under Alternative 3, along with increased rotation age (from 60 to 140 years), would result in even larger blocks of forest with no or limited harvesting, particularly for the next 60-70 years. The most notable additions (compared to the Preferred Alternative) would occur in the middle-western portion of the planning area (Lookout Mountain). Although "stand enhancement" thinnings or partial cuts would be allowed under this alternative, such treatments would also be limited due to the increase in "potentially inaccessible areas."

The increase in buffers and increased snag and leave tree retention proposed under Alternative 3 would likely result in a larger and more diverse dead and down tree component over the landscape. Depending on the distribution of leave trees, the increased retention could also result in fewer large openings, which in turn would affect ground vegetation. For further discussion, see the Lake Whatcom PDEIS, p. 229.

The long-term shift in seral stage on the landscape would likely be most pronounced under Alternative 3. A significant difference between this alternative and the No Action Alternative is projected to be observable after 50 years, with a sharp decline in the "pole" stage (from 22 percent under the No Action Alternative to 2 percent) and a significant increase in the "complex" stage (from 26 percent to 46 percent). Mature forest (defined in this context as at least 60 years old) would increase on the landscape at a faster rate and by a larger amount. After approximately 100 years, this alternative is expected to result in 25 percent more of the planning area being in the "complex" stage than under the Preferred Alternative, and 30 percent more than

under the No Action Alternative. After approximately 200 years, the landscape would have twice as much "old-growth" or "fully functional" stage than it would have under the No Action Alternative, and half again as much as it would under the Preferred Alternative.

Under Alternative 3, Life Form 8 is projected to experience a slight short-term increase in suitable habitat and decrease in primary habitat, and a larger long-term decrease in both types of habitat compared to the Preferred Alternative (as opposed to a long-term increase under the No Action Alternative). Life Forms 10, 11, 13, and 14 are expected to have short-term increases in habitats. This compares to short-term decreases expected under the other two alternatives for Life Forms 10 and 11, and lesser increases under the other two alternatives for Life Forms 13 and 14. Long-term trends for all of these life forms are expected to reach 99-100 percent of the landscape in primary and suitable habitat conditions.

It should be noted that species associated with early-seral conditions (including Life Form 8) are not uncommon or of concern, as there is an abundance of this habitat condition on a larger landscape level. Most forest species of concern are associated with older forest and especially large, roadless areas of such forest. Both the Preferred Alternative and Alternative 3 have the potential to perpetuate roadless areas (albeit, relatively small ones compared to designated wilderness areas, but still potentially significant, considering the rarity of low-elevation late-seral forest). Preservation or restoration of roadless areas is an essential component of management strategies designed to protect biological diversity (Franklin et al. 2000).

It should not be expected, however, that DNR lands in the Lake Whatcom watershed can provide anything like a "reserve." It should also be noted that the issue of larger landscapes and populations has been addressed in the DNR's HCP and the associated EIS for that plan, which considered broad, regional strategies for conservation.

Mitigation – Landscape Plan Proposal
Same as the No Action Alternative, although less mitigation would be needed due to fewer acres being harvested and fewer roads being constructed.

Unavoidable adverse impacts
Similar to the No-Action and Preferred Alternatives, but to a lesser degree, primarily due to less habitat fragmentation and fewer unroaded areas impacted.

Fish
Habitat Quality
Alternative 3 is more protective of riparian ecosystem functions than the No Action Alternative and the Preferred Alternative. It provides wider RMZs on all water types and careful regulation of timber harvest and road construction on potentially unstable slopes. Alternative 3 should maintain a high level of riparian function, and protect the stream channel from sedimentation caused by upslope landslide failures.

This alternative is more protective of riparian ecosystem function than the other two alternatives because it does not allow commercial harvest in an RMZ. Additionally, provision is made for stand-improving management in portions of the RMZ. These activities, in the form of thinnings

and tree species conversions, could hasten recovery of large diameter conifer trees, a desirable characteristic of "older forest conditions."

The wider wind buffer called for by Alternative 3 will further reduce potential damage to the interior RMZ, and the harvest allowed in the outer 50 feet of the wind buffer may make the RMZ more wind resistant.

Short-term and Long-term: Direct Impacts – Indirect Impacts
No probable, significant adverse impacts are identified. Alternative 3 will increase protection to riparian function and in-stream fish habitat.

Cumulative Impacts
Same as the No Action Alternative and the Preferred Alternative.

Mitigation – Landscape Plan Proposal
Same as the No Action Alternative and the Preferred Alternative.

Unavoidable adverse impacts
Same as the No Action Alternative and the Preferred Alternative.

Habitat Accessibility
Habitat will remain accessible to all native fish species, at all life stages. All fish-blocking culverts will be repaired with fish-passage structures, and replacement will occur during planned management activities or during implementation of the Road Maintenance and Abandonment Plan.

ENERGY AND NATURAL RESOURCES

Energy Resources (Coal, Oil, Gas, Hydropower)
No change in this alternative from the Preferred Alternative, which does not allow surface activity. This has been the current policy for new leases in the watershed. If angle or directional drilling from an adjoining non-state parcel cannot access a state parcel, then the lease application will essentially be denied.

As previously noted, some DNR parcels have a severed mineral estate; DNR cannot control exploration activity in those parcels within the watershed for DNR does not hold the mineral rights.

Mineral Resources (Sand, Gravel, Rock, Metals)
No change from the No Action Alternative.

Forest Resources (Timber, Special Forest Products)
Timber Resources
Alternative 3 makes 5,475 acres, or 35 percent of the project area available to harvest. The annual harvest is less than 10 percent of that under the No Action Alternative. No regeneration harvests are allowed.

Short-term: Direct Impacts – Indirect Impacts
The ability to begin harvest operations will be delayed until sufficient acreage and volume is available to cover costs of logging, new road construction, reconstruction, layout and administration costs. Thinnings in helicopter terrain may not be economically feasible. Delays in the extraction of timber are also expected until trees reach rotation age of 140. Very poor access and limitations on regeneration harvests limit options for logging equipment. Increasing retention levels increases all operational costs because of higher complexity of sale layout and logging, costlier logging methods, and higher levels of road construction (Burns, et al 1983). Some areas would be inaccessible to harvest, as landings suitable to helicopter operations would not be available.

Long-term: Direct Impacts – Indirect Impacts
Average rotations of 140 years are required under Alternative 3. A high reduction in average site index for lands available for harvest will occur, with subsequent reductions in yields per acre. Stands dominant with Douglas-fir will diminish over time and be replaced with higher levels of hemlock and cedar. The availability of red alder of commercial size will decrease over time.

Higher levels of retention offer an opportunity to produce larger trees with higher quality wood characteristics than those managed on shorter rotations. In order to extract value from larger wood, equipment capable of removing the logs will have to be larger, with subsequent higher logging costs. Current manufacturing processes and wood products design have been encouraging utilization of small dimension logs by local mills in the region. The financial value of larger and higher quality logs may be offset by the costs of hauling wood to mills that have not been retooled for smaller wood.

Cumulative Impacts

Table 6: Cumulative Impacts on Timber Harvest
Cumulative impacts of each alternative on the availability of acreage open to commercial harvests, average annual harvests, average harvest volumes per acre and the annual acreage treated as regeneration, thinning and partial cut harvests.

	No Action Alternative	**Preferred Alternative**	**Alternative 3**
Acres available for harvest or restoration activities	11,390	8,276	5,475
Percentage of 15,707-acre planning area	73	53	35
Draft average annual harvest volume (thousand board feet/year)	5,511	2,733	492
Draft average Harvest Volume (thousand board feet /acre)	37	30	9
Draft annual acreage treated as regeneration harvests	89	43	0
Draft average annual acreage treated as thinning harvests	47	35	18
Draft annual average acreage treated as partial cut harvests	11	13	11

Note: The numbers in this table are approximate, resulting from modeling analysis, and used for comparative evaluation for planning purposes only. (Source: Road Summary, Stuart, 2003; Comparison of February 02 Sustainable Harvest Model Run, Brodie, 2002.)

Mitigation – Landscape Plan Proposal
Unknown at this time

Unavoidable adverse impacts
Under any type of logging method, adverse impacts to soil and water quality can occur. All harvest practices can increase the potential for windthrow.

Special Forest Products
Short-term: Direct Impacts – Indirect Impacts
Alternative 3 limits vehicular access to large portions of the project area, creating moderate impacts to the ability to economically harvest special forest products.

Long-term: Direct Impacts – Indirect Impacts
Vegetation more tolerant of shade and in older forests will be favored by Alternative 3. Quality and quantity of moss is likely to increase. Fungal species which need maintenance of deeper, undisturbed layers of organic matter would be promoted by this alternative. Products that require full sunlight and open areas may not be available in sufficient quantities to be commercially viable. Wildflower honey from plants in early seral stage forests will be harder to find as access and site availability decrease (Alexander, A.G., 2002). The availability of harvestable boughs will be reduced (Alexander, S.J., 2002).

Cumulative Impacts
The primary impact would be financial, since Alternative 3 would result in reduced revenue potential for special forest products as compared with the No Action Alternative.

Mitigation – Landscape Plan Proposal
Unknown at this time.

Unavoidable adverse impacts
Possible conflicts with Native American traditional uses of medicinal plants may impact any commercial harvesting.

Carbon Sequestration
Alternative 3 would be less favorable from an efficiency standpoint for sequestering carbon than both the No Action Alternative and the Preferred Alternative since it significantly reduces the number of acres available for harvest. With reduced harvest activity there will be less forest regeneration with young, rapidly growing trees, which more actively remove and sequester atmospheric carbon than older trees on an annual basis. The amount of stored forest carbon under Alternative 3 may increase over time beyond what is captured in the No Action Alternative.

Built Environment

ENVIRONMENTAL HEALTH

Release of Toxics/Hazardous Materials
No significant adverse impacts are likely.

Risk of Explosion/Fires
Same as the No Action and Preferred Alternatives. There is very limited risk of explosions on DNR-managed lands within the Lake Whatcom planning area. No pipelines cross the planning area nor are there any other risk factors.

As discussed in the Affected Environment /Air section, past wildfire history (very few fires, each small in size) current zoning suggest that there is a low risk of fire threatening homes and other structures adjacent to state trust lands under all of the alternatives.

Risk of Slides, Floods, Debris Torrents
Short-term and Long-term: Direct Impacts – Indirect Impacts
The potential for short-term impacts to the built environment under this alternative would be low, and the potential would be reduced compared to both the No Action and Preferred alternatives. The reduction from the No Action Alternative would be due to less road construction and timber harvesting on sensitive slopes; reduced impacts from the Preferred Alternative would be because of less timber harvesting.

Cumulative Impacts
Similar to the No Action Alternative, but there would be a slightly reduced cost for road reconstruction.

Mitigation – Landscape Plan Proposal
Same as the No Action Alternative.

Unavoidable adverse impacts
Same as the No Action Alternative.

LAND & SHORELINE USE

Existing Land Use Plans/Growth Estimates
Land use plans and growth estimates are responsibilities of Whatcom County, its jurisdictions and other state agencies. They are not determined by DNR. The No Action Alternative, as well as the Preferred Alternative and Alternative 3, complies with the uses set for lands already zoned for commercial forestry. No zoning changes are anticipated as a result of this proposal.

Residential and Commercial Development
None of the three alternatives will affect residential or commercial development in the planning area.

Aesthetics
Short-term: Direct Impacts
Visual impacts under Alternative 3 should be less than under the No Action or Preferred alternatives because of increased buffers, and more areas restricted from harvest or limited to thinning. These patterns will tend to increase the visual complexity of the landscape and create more naturally shaped edges than under the other two alternatives. This is generally true across the landscape, except for the area north of Smith Creek on PDEIS Map S-1. Wind buffers will increase the visual softening influence of riparian buffers, but otherwise the patterns will be similar to the No Action Alternative in that area. Alternative 3 also would result in fewer new roads. Though this was not considered a significant element under the other two alternatives it would be even less of an issue under Alternative 3.

Recreation
All the alternatives are based on an objective to "manage dispersed, low impact recreation."

With larger areas not harvested for timber, there will be less evidence of human impact. This could enhance the recreational experience of some users. With fewer open canopy areas there may be reduced berry picking opportunities.

As there are fewer roads in the forest that are available for recreational users, access may become more limited and users may be more concentrated on fewer trails or roads. For example, equestrians use existing and abandoned roads, as well as unsanctioned trails. Use of the roads is year-round while trails generally are used during summer months when the soils are less saturated. If there are fewer roads equestrian use may become more concentrated, especially during the winter.

Enforcement needs, particularly to discourage off-road vehicle use, are expected to remain at present levels since access to much of the road system is blocked by gates in cooperation with other major landowners.

Cumulative Impacts
None identified.

Mitigation – Landscape Plan Proposal
No additional measures identified as needed.

Unavoidable adverse impacts
None identified.

Historic and Cultural Preservation
Short-term: Direct Impacts – Indirect Impacts
Under Alternative 3 full establishment of the cultural resources program is likely to move forward more quickly because this alternative commits the department to developing a Cultural Resource Management Plan with the affected tribes within one year of adopting the landscape plan.

Alternative 3 also references Lummi Tribal codes and resolutions. Due to constitutional, statutory regulatory and case law constraints, this portion of Alternative 3 could not be implemented in the Lake Whatcom watershed.

Additional cultural resource properties would be incidentally protected through increased natural resource preservation.

Agriculture
DNR holdings in the planning area typically are zoned for commercial forestry. The planning area contains no lands specifically designated as agricultural lands under the Whatcom County Comprehensive Plan.

Silviculture
Under this alternative, approximately one third of the project area, 5,475 acres will be eligible for commercial harvest. Choices of silvicultural systems are reduced.

Short-term: Direct Impacts – Indirect Impacts
Regeneration of stands will continue to emphasize current practices of artificial regeneration of Douglas-fir and western red cedar. Planting densities will be reduced slightly. Natural seeding will be utilized at higher elevations. Aggressive brush control will occur during the first 10 years. The alternative does not allow the use of aerially applied pesticides or fertilizers. Manual chemical treatments would be permissible under this scenario and could be employed for the more difficult brush species that are better controlled with aerially applied herbicides. This would result in moderate to high cost increases.

Long-term: Direct Impacts – Indirect Impacts
Studies show that reductions in the growth of Douglas-fir show significant impacts where retention moves above 20 percent (Brandeis et al. 2000). Some loss of conifer growth will occur as problem species that are not readily controlled by manual means out-compete conifer species. An increase in shade tolerant species will be favored.

All stands should be eligible for precommercial thinning. This alternative appears to have the most area harvested by helicopter, which will increase costs of all silvicultural activities.

Cumulative Impacts
The ability to control stand structure, stand composition and density, control rotation length, facilitate harvesting, and maximize timber yields are reduced compared with the No Action Alternative.

Mitigation – Landscape Plan Proposal
After a review of each site, the department selects from the following methods for controlling vegetation: no treatment, non-herbicide, ground-applied herbicide, and aerially applied herbicide. A method lower on the list may be used only if it substantially outperforms other methods (Forest Resource Plan Policy # 33).

Species and sizes of trees that have low survival rates in shaded areas could be increased through aggregated, rather than dispersed, patterns of retention.

Unavoidable adverse impacts
Under any type of logging methods, adverse impacts to soil and water quality can occur. All harvest practices can increase the potential for windthrow.

TRANSPORTATION

Transportation Systems (Forest Roads, Trail Systems)
Approximately 33 miles of road would be constructed. After abandonment of existing and constructed roads that are not needed for long-term use, a total of 31 miles could be expected to remain as permanent active roads. The resulting road density would be 1.3 miles per square mile. The combination of log and rock haul would result in an average of 1 round trip per day generated by forest management activities on DNR forests in the planning area (trips would be concentrated during construction or when harvest is taking place).

Short-and Long-term Impacts; Cumulative Effects
Possible environmental impacts are discussed in other sections under "Natural Environment." No significant impacts are expected related to maintenance or traffic. Alternative 3 may result in a less efficient road system and may limit DNR's ability to access some areas by vehicles for harvest (impacting the trust revenues), immediate fire suppression, and recreational users. This alternative would impact neighboring landowners' ability to access their land since the restrictions on road construction would apply to roads built under easements.

In addition to the mitigation measures listed for the Preferred Alternative, almost no new roads are allowed on potentially unstable slopes, and no new roads are allowed on unstable slopes under this alternative. Roads in these locations often need more frequent maintenance. This alternative would therefore reduce the amount of maintenance work required.

Mitigation – Landscape Plan Proposal
Prohibiting new road construction on unstable slopes eliminates the potential for maintenance or special design requirements in those areas. Review of potentially unstable slopes by a specialist would likely reduce long-term maintenance needs.

Unavoidable adverse impacts
Adverse impacts would be similar to those under the No Action and Preferred Aternatives but proportionally smaller due to fewer miles of road construction.

Traffic Hazards/Safety
The amount of hauling under Alternative 3 is far less than under the other two alternatives (averaged out at 1 round trip per day for comparison, although hauling events will tend to be more concentrated based on specific road building and harvest activities). No significant adverse impacts relative to traffic and safety are expected.

Forest Road Maintenance and Abandonment Plans
This alternative specifies that all high hazard roads, including orphaned roads, must be treated within three years. The shorter timeline for abandonment and road improvements would reduce the potential for road damage, compared to the No Action and Preferred Alternatives.

Short-term: Direct Impacts – Indirect Impacts
The expanded scope of work required under RMAPs would require additional DNR resources to successfully complete in three years. Initial assessment and prescription would take much of the first year to complete, leaving two years for repairs to be done – with stream crossings and higher elevation work limited to the dry season. This would be an aggressive project considering the size of the planning area.

Long-term: Direct Impacts – Indirect Impacts
None identified.

Cumulative Impacts
None identified.

Mitigation – Landscape Plan Proposal
Maintenance or abandonment work identified by the RMAP could be completed sooner than 2015 to reduce the potential for damage due to problems found in the assessment stage.

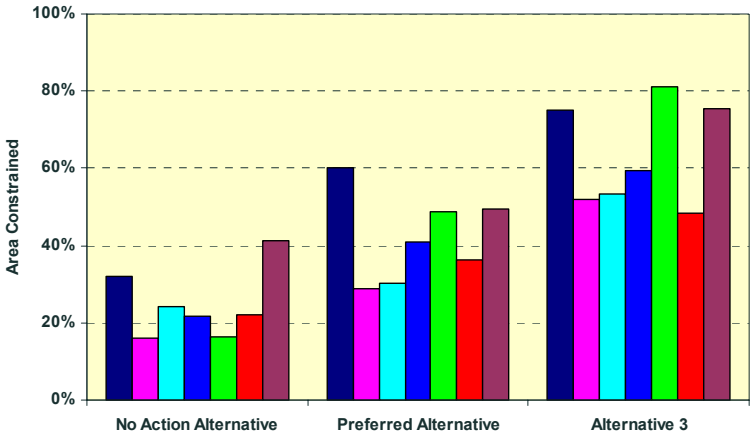
Unavoidable adverse impacts
None identified.

Water, Rail and Air Traffic
Timber harvest is reduced enough that helicopter logging would be less frequent than under both other alternatives. There would be no significant impacts.

PUBLIC SERVICES & UTILITIES

Relation to Trust Income: Analysis of total undiscounted revenue
Alternative 3 dedicates about 90 percent of the land's productive capacity for ecological and social benefits (Hulsey, 2002). For the percentage of land area by trust on which timber harvest is constrained for each trust under each alternative, see Figure 5.

Figure 5: Proportion of area on which timber harvest is constrained by management



Trust 1- Whatcom Co: Forest Board Transfer
Trust 1- Skagit Co: Forest Board Transfer
Trust 2- Whatcom Co: Forest Board Purchased
Trust 3: Common School (K-12)
Trust 4: Agricultural School (WSU)
Trust 7: Capitol Building
Trust 10: Scientific School (WSU)

Draft sustainable harvest calculations for Lake Whatcom suggest that Alternative 3 will return some $365,000 per year for the first two decades of the planning period ($1,422,000 per year less than the No Action Alternative), and $146,000 per year for the entire planning period ($1,558,000 per year less than the No Action Alternative). In effect, this amount would not be available for annual distribution to the state general fund for public services, or to trust beneficiaries, or to county junior taxing districts, or to the department's management funds. Further details regarding these revenue estimates are provided below.

Table 12: Estimated average annual harvest revenue reduction associated with choosing Alternative 3 over the No Action Alternative in the Lake Whatcom landscape and average annual revenue change relative to the No Action Alternative, by beneficiary group for the first two decades and the entire modeled planning period (200 years).

Beneficary entity	First two decades: Average annual revenue ($000)	First two decades: Change in average annual revenue ($000)	Entire planning period: Average annual revenue ($000)	Entire planning period: Change in average annual revenue ($000)
Whatcom County Forest Board Transfer				
Bellingham & Mt Baker School Districts	57	-222	23	-243
Bonds	19	-73	7	-80
Maintenance & operations	38	-149	15	-163
Whatcom County roads	26	-103	11	-113
Whatcom County	18	-72	7	-79
Library	6	-24	3	-27
Port of Bellingham	5	-19	2	-21
Whatcom County Conservation Futures	1	-3	0	-3
State General Fund	39	-153	16	-168
DNR Forestry Development Account	43	-168	17	-184
Whatcom County Forest Board Purchased				
Bellingham & Mt Baker School Districts	3	-12	1	-13
Bonds	1	-4	0	-4
Maintenance & operations	2	-8	1	-9
Whatcom County roads	1	-5	1	-6
Whatcom County	1	-4	0	-4
Library	0	-1	0	-1
Port of Bellingham	0	-1	0	-1
Whatcom County Conservation Futures	0	0	0	0
State General Fund	2	-8	1	-9
DNR Forestry Development Account	8	-31	3	-34
Skagit County Forest Board Transfer				
Burlington-Edison School District	6	-25	3	-27
Bonds	3	-12	1	-13
Maintenance & operations	3	-13	1	-14
Skagit County roads	3	-10	1	-11
Skagit County	2	-8	1	-9
United General Hospital	1	-3	0	-3
Port of Skagit	0	-1	0	-1
Skagit County Medic 1	0	-1	0	-1
Skagit County Conservation Futures	0	0	0	0
State General Fund	4	-15	1	-16
DNR Forestry Development Account	5	-18	2	-19
Common School (K-12)				
Common School (K-12)	81	-315	32	-345
DNR Resource Management Cost Account	27	-105	11	-115
Agriculture School (WSU)				
Agriculture School (WSU)	4	-18	2	-19
DNR Resource Management Cost Account	0	0	0	0
Capital Buildings				
Capital Buildings	5	-19	2	-21
DNR Resource Management Cost Account	2	-6	1	-7
Scientific School (WSU)				
Scientific School (WSU)	10	-38	4	-42
DNR Resource Management Cost Account	3	-13	1	-14
TOTAL	365	-1,422	146	-1,558

Notes:
1: Trusts denoted in bold typeface; associated beneficiary groups denoted in regular typeface
2: Totals may not add due to rounding

Analysis was completed for carbon sequestration, green certification and recreation leasing:

Carbon sequestration: The cost of sequestering additional carbon under Alternative 3 is likely to exceed the cost of simply planting bare land for carbon sequestration. This prospect means returns for carbon sequestered in the Lake Whatcom landscape (if any) would probably not produce revenues sufficient to financially justify this choice.

Green certification: Whether or not certified lumber products attract a premium price in the market, any price premium associated with certified softwood lumber would have to return at least $1,400/Mbf to the forest grower, in order to financially justify choosing Alternative 3 over the No Action Alternative, because of the greatly reduced timber harvest. It appears highly unlikely that forest growers will realize price premiums of this magnitude, especially within the context of current lumber and stumpage prices.

Recreation leasing: None of the alternatives proposes a destination resort on state trust lands near the shores of Lake Whatcom. However, because this would generate some of the highest recreation returns, it was used as a test case, to see if recreation income could effectively offset reductions in timber revenues. Estimated lease revenues from a hypothesized destination resort development on the shores of Lake Whatcom are unlikely to completely offset timber harvest revenues foregone under Alternative 3.

Finally, it appears highly unlikely that combined revenues from carbon sequestration, certified lumber production and leasing of trust land for recreation activities could financially justify the choice of Alternative 3 over the No Action Alternative (Glass, 2003).

Fire

Short-term and Long-term: Direct Impacts – Indirect Impacts

The risk of fire is relatively low, and unchanged from the No Action Alternative. Short-term direct impacts of fire on DNR-managed lands include damage to the forest itself, risk of damage to neighboring properties, loss of habitat and potentially increased risks to water quality. In both the short and long term, fires pose potential loss of trust assets in the form of timber and other forest products, and the associated reduction in income potential for federally granted trusts, as well as for counties should Forest Board lands be damaged by fire. Fire damage also could negatively affect aesthetics, both from the standpoint of views and by diminishing the desirability of the Lake Whatcom area for recreational use.

Police

No change from the No Action Alternative.

Schools

Short-term and Long-term: Direct Impacts – Indirect Impacts

The reduced timber harvest level would result in significantly smaller revenue contributions to the Common School Construction Account, Bellingham and Mt. Baker school districts and to the state general fund, which would reduce the amount of legislative funding available for both K-12 school construction and renovation and other education-related needs.

Parks and Recreation Facilities
No change from the No Action Alternative. There are no parks or developed recreation facilities located on DNR trust lands. No direct impacts are expected to facilities located on adjacent public or private lands.

Communications
No change from the No Action Alternative. Alternative 3 neither impacts communication site leases nor limits new site opportunities. DNR would continue to lease communication tower and building space, increase rental rates as market conditions allow, and seek new customers.

Water/Storm Water Management
There are no probable significant impacts to bridges or the Brannian Creek fish hatchery water intake from peak flows under this alternative.

Sewer/Solid Waste Management
No change from the No Action Alternative. Since most DNR-managed lands in the planning area are designated for commercial forest uses there has been no need for sewer or solid waste planning. Solid waste management has been limited to cleanup of unauthorized garbage dumping.